SB761
U7I5
88-9

UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE

FOREST PEST MANAGEMENT

STATE & PRIVATE FORESTRY

INTERMOUNTAIN REGION

3420
Report No. R4-88-9
May 1988

EVALUATION OF DWARF MISTLETOE CONTROL PROJECTS ESCALANTE RANGER DISTRICT, DIXIE NATIONAL FOREST

by
Ann M. Keysor
Biological Technician

INTRODUCTION

Ponderosa pine and Douglas-fir timber stands on the Escalante Ranger District, Dixie National Forest, were evaluated for proposed dwarf mistletoe suppression projects on August 19-20, 1987. The areas surveyed are located in the following timber sales: Bear Creek, Side Hollow, Hungry Creek, Hog Ranch, Under Barney Top, and Clay Creek. These stands are hosts to either the southwestern and/or the Douglas-fir dwarf mistletoes. Each area will be discussed separately.

ACKNOWLEDGEMENT

Appreciation is extended to Kirsten Marquart and Cindy Muhlhausen for assistance in field work.

OBJECTIVES

The objectives of this evaluation are to provide recommendations to reduce ponderosa pine or Douglas-fir losses due to dwarf mistletoe to acceptable levels through efficient and economical methods. Losses due to dwarf mistletoe in established stands can be reduced without attempting to eradicate the disease.

LIBRARY COPY
ROCKY MTN. FOREST & RANGE
EXPERIMENT STATION

METHODS

The stands were walked through and visually surveyed for the presence of DM infected overstory and understory trees, and regeneration. Data was taken at Bear Creek, Side Hollow, and Clay Creek. The data recorded on 10 or 20 BAF variable plots included species, dbh, and dwarf mistletoe rating (DMR). Fixed plots (1/300 acre) surveyed trees less than 4.5′ tall or 1" dbh to record species, approximate height, and if infected by dwarf mistletoe. The DMR of infected trees was noted at the other units.

RESULTS and RECOMMENDATIONS

The Escalante Ranger District has developed the following silvicultural control treatment of dwarf mistletoe infected ponderosa pine. When a ponderosa pine stand is heavily infected with dwarf mistletoe and in a site difficult to regenerate, the stand is cut to a 40 basal area factor (BAF). In areas with a heavy understory, trees over 8 inches DBH are cut and the remaining trees are thinned to 40 BAF, discriminating against dwarf mistletoe infected trees. The areas are under-planted and any infected trees remaining are removed after the regeneration is established (at least 5 years). In areas with lighter infection, the trees are cut when merchantable (15-20 years) then under-planted. Openings next to these lightly infected trees are planted. Pockets of infected trees are removed and replanted if they are about 1 acre in size. These (and the following) silvicultural practices should provide the best method of reducing the amount of dwarf mistletoe infection in the future while providing enough site protection for the seedlings to become established.

Bear Creek Timber Sale

The ponderosa pine in this area is heavily infected in patches along the ridgeline above the unit. Trees in 4 of 5 plots were heavily infected and one was moderately infected. The road below this area will be used as a buffer from further infection after the infected trees are clear cut and replanted. The lightly infected trees below the road were thinned and will be harvested in 15 to 20 years. This area will not be replanted until the lightly infected trees are removed.

Side Hollow Timber Sale

Based on 10 (10 BAF) variable plots taken in a ponderosa pine stand, 50 percent of the area is heavily infected, 30 percent is lightly infected, and 20 percent had no visible infection. Trees 8 inches DBH and larger will be removed leaving scattered heavily infected trees. These trees should be removed as soon as the regeneration becomes established.

Hungry Creek Timber Sale

This ponderosa pine unit has been cut and thinned leaving scattered heavily infected trees (average DMR 4-5) to provide protection until the regeneration becomes established. Within 5 years after planting, the infected trees will be removed.

Hog Ranch Timber Sale

The ponderosa pine stand was thinned to a 40 BAF and seedlings were planted under infected overstory trees until the seedlings become established. These infected trees will be cut if and when the seedlings become established. Of the 20 understory trees 1-15 feet tall, 14 trees 1-3 feet tall had no visible infection, and 6 trees 3-15 feet tall had dwarf mistletoe plants. Because it is extremely difficult to establish seedlings on this site without the use of infected overstory trees to provide shade, the regeneration is highly susceptible to infection. Pruning (or the use of ethephon) might be an option to reduce the spread of dwarf mistletoe seeds until the seedlings can become established. Pruning infected branches of established regeneration could be cost effective as opposed to killing the tree.

Clay Creek Timber Sale

This area is composed of ponderosa pine, Douglas-fir, blue spruce, white fir, rocky mountain juniper, and aspen. Pockets of dwarf mistletoe infected ponderosa pine and Douglas-fir trees are scattered throughout the unit. At least one, if not both species of dwarf mistletoe, had infected trees on 4 of 5 plots surveyed. Overstory trees over 8" DBH will be cut and the remaining trees thinned to a 60 BAF. In areas with an infected Douglas-fir overstory and ponderosa pine understory, the Douglas-fir will be removed, and in areas with an infected ponderosa pine overstory and a Douglas-fir understory, the pine will be removed. The use of non-host trees (including aspen) as buffers to slow the spread of dwarf mistletoe seed is very effective.

Under Barney Top Timber Sale

This subalpine fir habitat type contains limber pine, aspen, white fir, blue spruce, and dwarf mistletoe infected Douglas-fir. The timber sale will remove all trees (including the infected Douglas-fir) over 8" DBH. The remaining trees will be thinned to a 40 BAF (discriminating against infected Douglas-fir) to provide site protection to the regeneration. At least 5 years later, any infected Douglas-fir will be removed. The area below the road will be cut then burned for wildlife habitat improvement. The improvement costs should be shared by the benefiting functions.

SOUTHWESTERN DWARF MISTLETOE

Southwestern dwarf mistletoe (Arceuthobium vaginatum subsp. cryptopodum) (SWDM), is the most damaging disease of southwestern ponderosa pine (Pinus ponderosa) var. scopulorum. The disease causes mortality and growth reduction in infected Ponderosa pine (Pinus ponderosa); causes a decrease in the quantity, quality, and germination percentage of seeds produced; and lowers timber quality. Heavily infected trees are more susceptible to attacks by insects and other diseases and to environmental stresses such as drought. Heavily infected trees may sustain a 20 to 50 percent reduction in growth when compared to non-infected trees. Dwarf mistletoe infects trees of all ages and is thus a problem in second growth and regeneration, as well as mature and overmature stands.

Biology

Dwarf mistletoes are parasitic, seed-bearing plants that depend on their hosts almost completely for their water and nutrients. Spread of SWDM occurs in late July and early August when water pressure builds up inside the mature fruits and the seeds are expelled to distances ranging from 17 to 40 feet. The average horizontal distance of seed flight is between 15 and 20 feet. Infection of trees through the bark on needle-bearing shoots occurs within a few months after dispersal. Aerial shoots appear between 2 to 5 years after infection. Spread of SWDM in ponderosa pine stands is a function of stand age, density, and site index, and averages 1 to 2 feet a year through a single-storied stand. Spread is most efficient and rapid from an infected overstory to an understory and slowest through even-aged stands.

Prevention

Prevention is the most efficient and economical method of reducing dwarf mistletoe impact. To prevent an infestation from starting, all infected trees should either be removed or killed in each regeneration area, including burns, before the new stand can become infected. Boundaries should be located in uninfected or non-host type stands, or along natural breaks. Trees which do become infected should be removed during intermediate cuts.

Silvicultural Control

Losses due to SWDM throughout the ponderosa pine stands can be effectively reduced to acceptable levels in managed stands through judicial thinnings and regeneration cuts. Because the distribution of SWDM tends to be very patchy, selective removal of DM infected overstory will be needed to reduce the spread of the disease. Major management options include the following:

(1) Regenerate the infected stand using treatment layouts which reduce reinvasion by the pathogen.
(2) Remove infected trees and improve tree growth by thinning.
(3) Change stand composition to non-susceptible hosts.
(4) Remove infected residuals from logged or burned stands.

Treatment of stands with Heavy Infection

Stands with a DMR of 4, 5, or 6 are heavily infected and are declining in growth rate and vigor, and are poor risk trees. Heavily infected patches usually contain infected pines of all age and size classes. Thinning heavily infected stands will only accelerate the spread of the disease and cause increased growth reduction and subseqquent tree mortality. Heavily infected stands that will not provide acceptable yields or meet other objectives should be regenerated. Stands should be regenerated through shelterwood or clear cuttings to remove the infection source and establish a new vigorous stand. The best regeneration method is clearcutting infected patches. The size of clearcuts should be at least 20 acres to reduce the amount of infection in the regeneration from the infected edges.

When infected trees must be left for shelter or seed source, trees with infection in the lower third of the crown should be favored over more heavily infected trees. Pruning the infected branches of leave-trees could increase

the number of years before the regeneration becomes infected. Cut these (and all other) infected overstory trees once regeneration is established in the cut area, but no later than 10 years. The new stand should be thinned about five years after overstory removal. This allows diagnosis of most latent infections.

Planting more than the usual amount of seedlings underneath the infected leave-trees, could result in a greater number of healthy trees remaining after the infected leave-trees and any infected seedlings are cut.

Treatment of Stands with Light Infection

Stand with a DMR or 1, 2, or 3 are lightly infected and usually result in little or no impact on growth of pole- and sawtimber-size trees. Lightly infected trees may be left in even-aged stands if they are otherwise desirable as crop trees and needed for stocking. Since the majority of SWDM seeds fall within 30 feet of the parent plant, spacing lightly infected leave trees in even-aged stands at distances greater than 30 feet should substantially reduce the rate of spread in these stands. Infected trees should be discriminated against during any intermediate cuttings.

Pruning

Pruning should only be used on large, valuable trees that would retain at least 30 percent live crown after pruning. Pruning is used when lightly infected trees, pole size or smaller, can be sanitized and there is little chance they will be reinfected. Two whorls of branches above the highest visibly infected branch should also be removed to eliminate latent infections. The following three steps should be used in removing large tree limbs:

(1) Undercut a few inches away from the main trunk to prevent bark stripping.
(2) Remove the limb with a cut just outside the undercut.
(3) Remove the stub with a cut at the branch collar.

Sanitation and Thinning

Sanitation cutting and thinning is used to maximize growth of lightly infected and healthy trees. Infected trees should be discriminated against when cutting.

Chemical Control

The growth regulator Florel™, containing the active ingredient ethephon has been approved by the EPA for use on dwarf mistletoes. Research suggest this chemical has "potential" in limiting the spread of the disease in high-use developed sites and home sites. The use of ethephon is only a temporary means of limiting the spread of dwarf mistletoes. Ethephon causes the dwarf mistletoe plants to separate from the host. The dwarf misteltoe is still active within the host and will produce aerial shoots in 2 to 5 years. This growth regulator should only be applied to high-value trees because of the expense involved. Sufficient guidance from knowledgeable scientists is recommended in the use and application of ethephon because it is such a new product.

DOUGLAS-FIR DWARF MISTLETOE

Douglas-fir dwarf mistletoe Arceuthobium douglasii. Infection by this parasite causes a reduction in vigor of the host tree, which predisposes it to attack by other pests, especially bark bettles.

BIOLOGY

Dwarf mistletoes are parasitic flowering plants which spread by forcibly ejected seeds. Seeds are dispersed in late summer to early fall for distances up to 50 feet from the host tree and adhere to the needles or twigs they strike. Germination takes place in early spring. Infection of the host takes place through tissues less than 5 years old. Penetration of the bark is followed by the development of sinkers in the host xylem. Under ideal conditions, aerial shoots are produced 2 to 5 years after infection, and flowering occurs 1 to 2 year after shoots emerge.

All size classes of Douglas-fir can be infected with dwarf mistletoe. Larger overstory trees, which are heavily infected, pose a threat to the advanced regeneration. Although dwarf mistletoes are usually host-specific, subalpine fir are infected with dwarf mistletoe. Subalpine is rated as a "rare host" for Arceuthobium douglasii. This susceptibility class indicates that 0 to 5 percent of the subalpine fir can be infected within 20 feet of an infected Douglas-fir.

Dwarf mistletoe infection levels can be effectively reduced by removal of infected overstory trees and sanitation thinning of the susceptible understory. Encouraging regeneration or planting immune species is a viable alternative where infected overstory trees need to be retained. Since killing the host tree kills the dwarf mistletoe as well, infected trees can be girdled and left standing.

FOREST PEST MANAGEMENT ASSISTANCE

Forest Pest Management can assist the District in surveying areas in need of treatment and can provide funding for dwarf mistletoe suppression. Control of dwarf mistletoe can be funded by timber sale, KV, Reforestation and Stand Improvement, and FPM funds. Funding will be shared with other benefiting functions. Requests for FPM funds for dwarf mistletoe control should be submitted to the Forest Supervisor and should be incorporated in the multi-year Program Development and Budget process (FSM 3462.14 R-4 SUPP 3).